includes imaging data, such as cardiovascular magnetic resonance imaging (MRI) or echocardiography, and complete hemodynamic assessment and laboratory data. Cardiovascular MRI generally provides superior RV functional assessment compared with echocardiography. Unfortunately, not all patients being evaluated for cardiac surgery are candidates for cardiovascular MRI because of hemodynamic instability or the presence of incompatible devices, such as pacemakers or defibrillators, intra-aortic balloon pumps, and left ventricular assist devices. Echocardiography, either transthoracic or transesophageal, can be performed at the bedside or in the operating room, and therefore has the advantage of providing immediate feedback on the impact of various interventions, such as fluid administration, adjustment of ventilator parameters, pressor and inotrope adjustment, and weaning from cardiopulmonary bypass.

A thorough hemodynamic evaluation is required to interpret the significance of pulmonary artery pressures. As RV dysfunction progresses to outright RV failure, pulmonary pressures and cardiac output decrease, and right atrial pressure increases. This concept has been used widely to predict the risk of RV failure after left ventricular assist device placement with the RV stroke work index ([pulmonary artery mean – radial artery mean] · confidence interval/hazard ratio).[1] A simpler determination of the ratio of right atrial pressure to pulmonary capillary wedge pressure is insightful, with values greater than 0.63 indicating higher risk for RV failure.[2]

Finally, laboratory evaluation of hepatic and renal function provides another means of assessing RV function. Elevated aspartate aminotransferase, bilirubin, and blood urea nitrogen are predictive of RV failure after left ventricular assist device placement.[2,3] Likewise, the Model for End-Stage Liver Disease, consisting of total bilirubin, international normalized ratio, and creatinine, predicts mortality for tricuspid valve surgery.[4]

The final major point of our publication is that pulmonary hypertension in the setting of isolated coronary artery bypass grafting carries a higher risk compared with valvular heart disease, likely because pulmonary pressures rapidly improve with correction of valve lesions but not with revascularization.[5]

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THE IMPORTANCE OF THE POSTERIOR LEAFLET ANGLE IN CHRONIC ISCHEMIC MITRAL REGURGITATION

To the Editor:

I have read with great interest the article by Fino and colleagues.[1] Their conclusions are very interesting. However, it would seem that the success rate achieved with the technique described originally by Bolling and colleagues[2] is unacceptable and the complication rate is unacceptably high. Restrictive mitral annuloplasty inserting a small ring, often 26 mm or 28 mm, is based on the principle of anterior advancement of the posterior mitral annulus. So, the tethered posterior leaflet (PL) meets the anterior leaflet in a more anterior displaced closure line. Consequently, the effective mitral valve area is reduced. Complete prosthetic annuloplasty rings to treat chronic ischemic mitral regurgitation are an absolute must because there is an anteroposterior annular enlargement[3] in addition to the asymmetric PL tethering.[4] It is therefore clear that, in restrictive mitral annuloplasty, the higher the PL angle, the greater the need for mitral valve closure line anterior displacement, and more likely the possibility of over reduction of the mitral valve area. We have addressed this issue in the study by Magne and colleagues.[5] Restrictive mitral annuloplasty in chronic ischemic mitral regurgitation is most likely to fail in patients with a PL angle greater than 45 degrees by echocardiographic study. The best predictor of postoperative persistence of mitral regurgitation was a PL angle greater than 45 degrees. Since 2011, we have selected exclusively patients with a PL angle less than 45 degrees for restrictive mitral valve annuloplasty in chronic ischemic mitral regurgitation. This approach has drastically reduced the need to use very small rings. We had no need to use 26-mm rings. Usually, 28-mm or 30-mm complete rings achieve good mitral coaptation while solving the problem of over reduction. This fact may be due to a decreased need for anterior displacement of the mitral valve closure line when the PL angle is less than 45 degrees.

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Reply to the Editor:

We greatly appreciated the comments of Dr Garcia-Villareal regarding our recent article.[1] On the basis of a previous study,[2] we aimed to analyze mitral valve hemodynamic performance, both at rest and during exercise, of patients with functional mitral regurgitation (MR) who received either restrictive annuloplasty or mitral valve replacement. We agree with Dr Garcia-Villareal that implanting the smallest ring size (24-26 mm) would be more likely to lead to abnormal postoperative transmitral gradients, particularly if the cardiac output is normal or increased. However, in our surgical series, only 6 patients (17%) received a 26-mm ring, whereas 83% of our population received a ring of 28 mm or greater. Despite this surgical policy, patients with annuloplasty showed no exercise-induced changes in indexed effective orifice area. In contrast, patients with mitral valve replacement had better exercise mitral valve hemodynamic performance and mitral opening reserve. Thus, our results suggest that even in patients with relatively high implanted ring size, exercise functional mitral stenosis, resulting in increased systolic pulmonary arterial pressure, may occur.

Our findings suggest that sparing mitral valve replacement may be considered as an alternative valid surgical option, even with the obvious limitations.

As underlined by Dr Villareal, "complete prosthetic annuloplasty rings to treat chronic ischemic mitral regurgitation are an absolute must as there is an antero-posterior annular enlargement in addition to the asymmetric PL tethering."

In this context, the outcome after mitral valve annuloplasty can largely be predicted by a posterior high leaflet angle (>45°), regardless of the tethering pattern.[3]

Any strategy aiming to avoid the risk of persistent or recurrent MR after surgery should be promoted and performing a sparing mitral valve replacement in those with high posterior leaflet angle could be very beneficial by reducing the need for smaller ring size in some cases.

However, anterior leaflet restriction should not be overlooked in understanding and repairing mitral valve tethering.[3]

The reasonable option introduced by Dr Villarreal, selecting rings between 28 and 30 mm, requires validation. Nevertheless, our data suggest that even with a ring 28 mm or greater, functional mitral stenosis and limited exercise hemodynamic performance may be frequent. This shows the real difficulty faced by surgeons when selecting ring size for mitral valve repair in patients with functional MR; that is, to concomitantly avoid persistence/recurrence of MR and risk of postoperative functional mitral stenosis. Current data from the literature seem to suggest that whatever gains are obtained in the reduction of recurrent MR risk by even more restrictive annuloplasties, they are likely to be lost by the introduction of functional mitral stenosis.[1,4]

Hence, despite the rule to promote not "very aggressive undersizing," restrictive mitral annuloplasty only addresses annular dilatation with a minimal impact on the subvalvular tethering.

Awaiting new insights, the ideal approach in well-selected patients would be to consider sparing mitral valve replacement[5] or a ring with adjunctive surgical procedures targeting the subvalvular tethering.

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